
***Lake Sturgeon (*Acipenser fulvescens*) Spawning
Assessments: Mississauga River, 1998-2002***

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S u m m a r y

Spawning lake sturgeon were netted at the Mississauga Chutes, Mississauga River four years, 1999-2002. A total of 363 lake sturgeon were captured using short-set gill netting, biologically sampled, tagged and released. Individuals ranged in age from 6 to sixty years. A total of 37 year classes were represented. The growth rate of lake sturgeon spawning in the Mississauga River is more rapid than elsewhere on Lake Huron. Total annual mortality was estimated at 12.3 percent. The year class distribution is bimodal in appearance. The mean age of captured lake sturgeon was 20.5 years.

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Paul Chiblow and Gary Stevens display two lake sturgeon captured near the Mississaugi Chutes.

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Introduction

The Mississagi River meanders through Bark Lake, north of Elliot Lake, and south to Blind River where it enters into the North Channel of Lake Huron (Figure 1). Mississauga First Nation encompassing 162 square km. (40,000 acres) of land, borders on the Mississagi River and the North Channel of Georgian Bay, west of the town of Blind River.

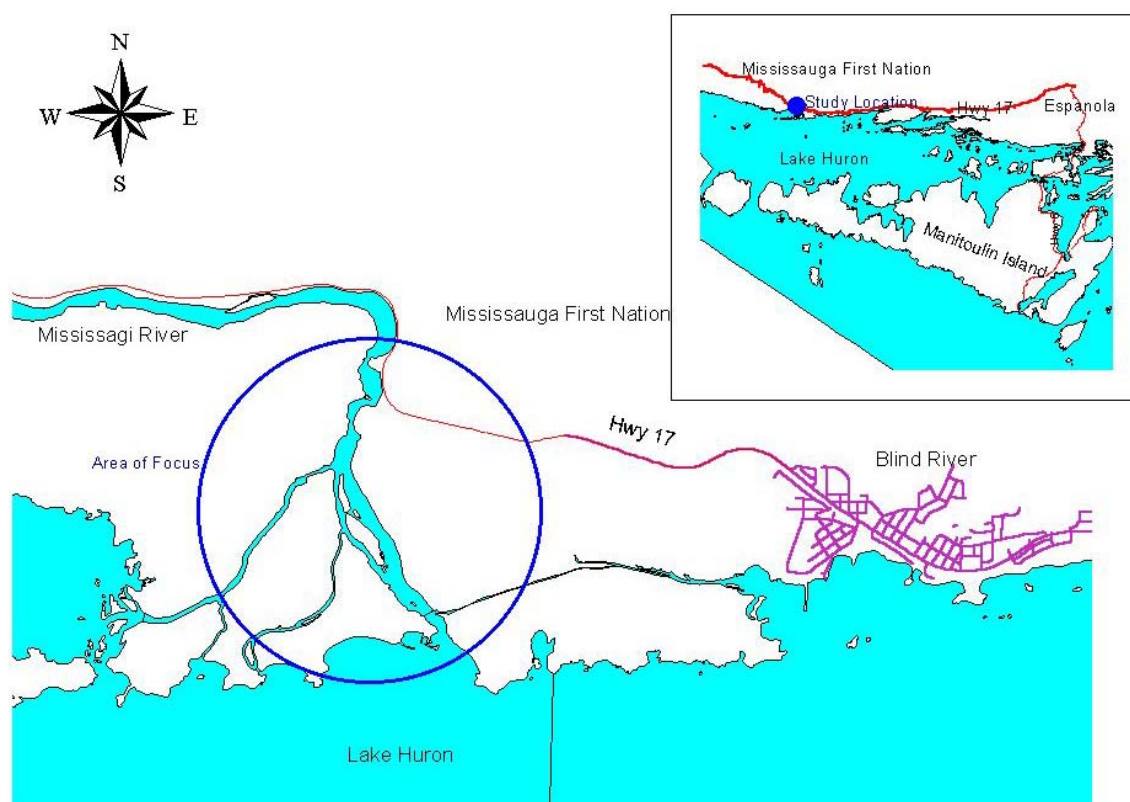


Figure 1. Geographic Setting of the Mississauga River.

Over the last century, development and commercial exploitation, has been blamed for the drastic reduction in lake sturgeon catches throughout their range. Considered a nuisance to fisherman prior to the late 1800's, the species was heavily exploited over a relatively short period. Commercial catch records reflect the rapid decline in Lake Sturgeon abundance. Figure two illustrates historical data for Lake Huron. This pattern was mirrored across the species' range. Commercial catch records for the North Channel date back to the early 1900's (Figure 3). Lake sturgeon harvests in the main body of Lake Huron were already in decline by that time and the lake sturgeon harvested from the North Channel made up a substantial part of the total harvest thereafter. Between 1920 and 2000 lake sturgeon from the North Channel made up 43.5 percent of the total Lake Huron harvest (Baldwin et al 2002).

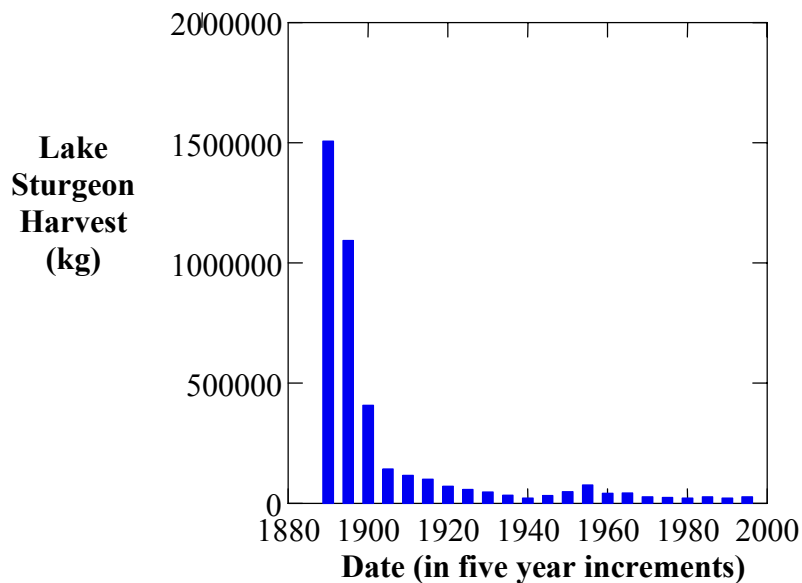


Figure 2. Commercial Lake Sturgeon Harvest from Lake Huron (U.S. and Canadian waters combined): 1890-2000 (Source: Baldwin et al 2002).

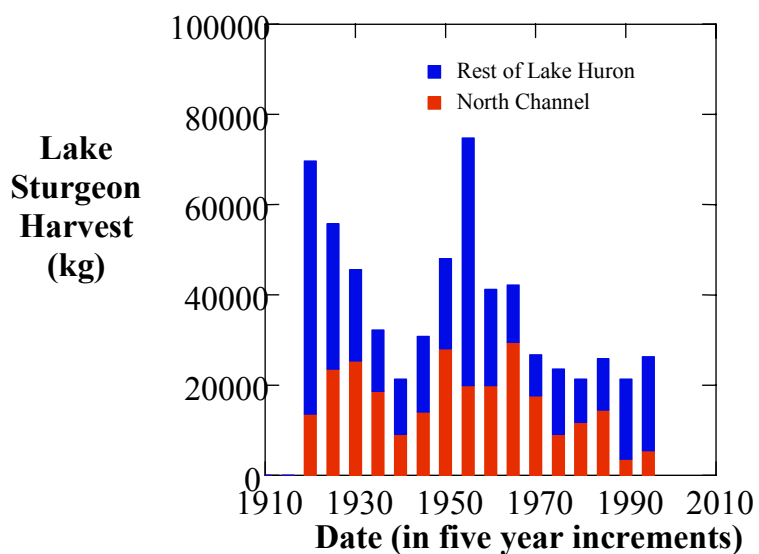


Figure 3. Commercial Lake Sturgeon Harvest the North Channel and the Rest of Lake Huron: 1920-2000 (Source: Baldwin et al 2002).

No lake sturgeon are commercially harvested from the Michigan waters of Lake Huron where the species is listed as 'threatened'. A limited harvest takes place in Canadian waters. Fish community objectives established by the Great Lakes Fishery Commission specify the importance of rehabilitating lake sturgeon throughout the lake (DesJardine et al 1995).

In addition to commercial exploitation, lake sturgeon habitat, particularly in inflowing tributaries, was impacted by the construction of dams and reservoirs throughout the twentieth century. Access to spawning sites was impeded in many rivers as lake sturgeon habitat became more and more fragmented by manmade barriers.

A series of hydroelectric facilities and storage reservoirs were constructed on the Mississauga River in the late 1950's and 1960's. The Red Rock Generating Station, owned by Mississauga Power was constructed in 1959. It is the first obstruction upstream from the mouth of the River and is an impassible barrier. The Red Rock facility is operated as a daily peaking plant. It is located 28 km upstream of the Mississauga River Chutes which is utilized as a spawning area by a variety of fish species including lake sturgeon (Figure 4).

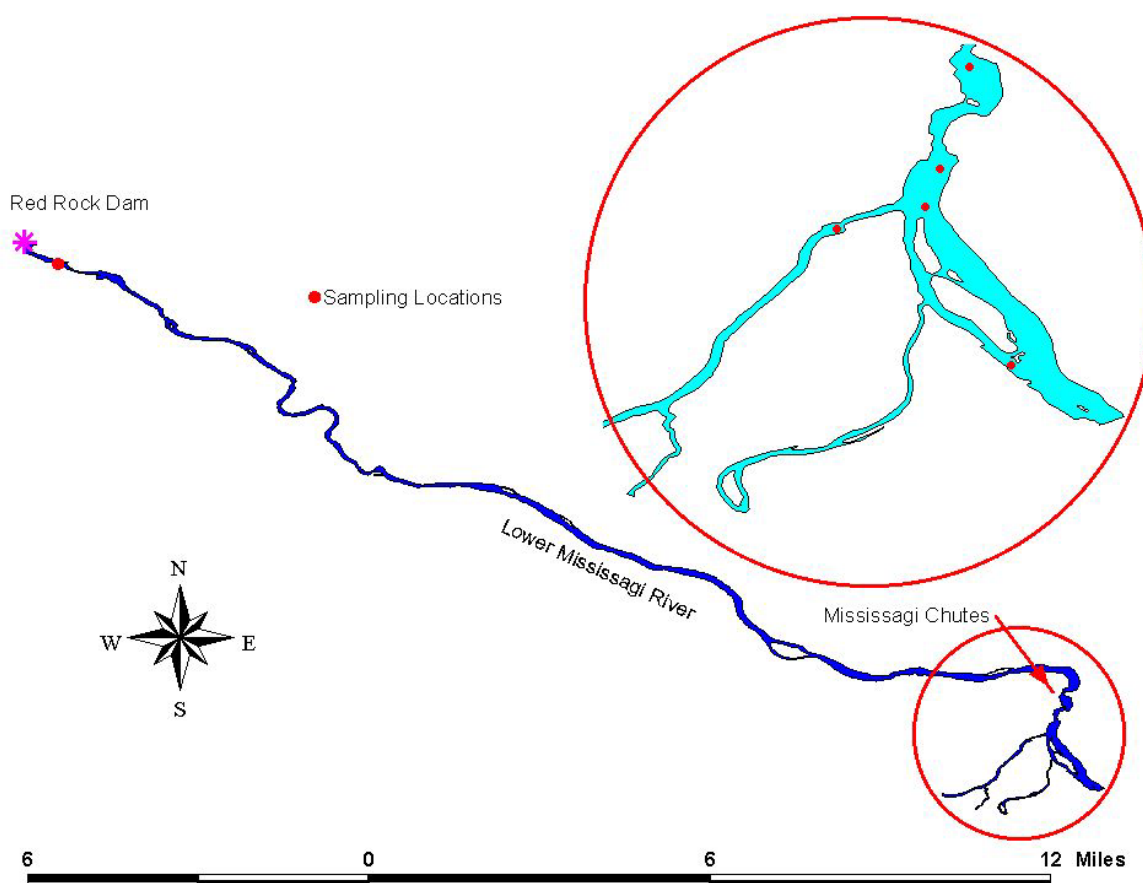


Figure 4. Lower Mississauga River.

Mississauga First Nation has utilized lake sturgeon from the river as a food source for centuries. Harvesting of lake sturgeon at the Chutes, using spears takes place throughout the summer months. This harvest has never been quantified. A survey conducted by the Mississauga First

Nation in 1997 revealed that community members were concerned about the declining lake sturgeon population. As a result of this concern, Mississauga First Nation felt it necessary to assess the local lake sturgeon population.

Mississauga First Nation, with technical support from the Anishinabek/Ontario Fisheries Resource Centre, assessed lake sturgeon during their spawning period for four years between 1999 and 2002. Intensive short duration gill netting was completed immediately below the Chutes in order to examine the characteristics of the Mississauga River lake sturgeon population. This report summarizes biological data collected during the four years that lake sturgeon were captured and tagged at the Mississauga Chutes.

Methods

Two 91.4 meter (300 foot) gill nets were set at randomly chosen locations immediately below the Mississauga Chutes. Net gangs consisted of panels of 22.8 cm (9 inch), 25.4 cm (10 inch) and 30.4 cm (12 inch) mono-filament mesh. Nets were 1.8 meters (6 feet) deep. Set duration varied between 1 to 4 hours for the most part. Several overnight sets were completed during periods when lake sturgeon catches were low.

Lake sturgeon were measured (total and fork lengths) and weighed. A numbered metal tag was affixed to the rear edge of the dorsal fin. Sex was determined through external, visual observation (emission of eggs or milt during sampling). The sex of unripe lake sturgeon was recorded as unknown. A small section of pectoral fin ray was removed from the base of the fin for aging. All lake sturgeon were live released following biological sampling.

In the spring of 2002 bathymetric mapping was completed on the lower Mississauga River using a Bathymetric Automated Survey System (B.A.S.S.) in order to identify pools which might act as high flow refugia or staging areas for juvenile and spawning lake sturgeon. In June 2002, following the spawning period, the netting gear described above was used to determine lake sturgeon presence/absence in the pools identified by the mapping exercise.

Aging was completed by Labman Aging Services Limited. All data were entered into an electronic data base using FishNet 2.0 software (OMNR 1998). Data were analyzed using SYSTAT 6.0 (SPSS 1996). Data collected over the four years has been pooled in order to describe the biological characteristics of the Mississauga River lake sturgeon population.

Results

A total of 363 lake sturgeon were captured between 1999 and 2002 (Table 1). All but five of these were captured at the Mississauga Chutes. The remaining five lake sturgeon, all adults, were captured in pool, approximately 1 km below the Chutes in 2002. No lake sturgeon were captured in any of the other pools identified during bathymetric mapping. Although some lake sturgeon were recaptured during the spring they were tagged, no tagged fish were recaptured in subsequent years. In 2000, two fin clipped lake sturgeon were captured without tags. It was unclear where or when these individuals may have been biologically sampled.

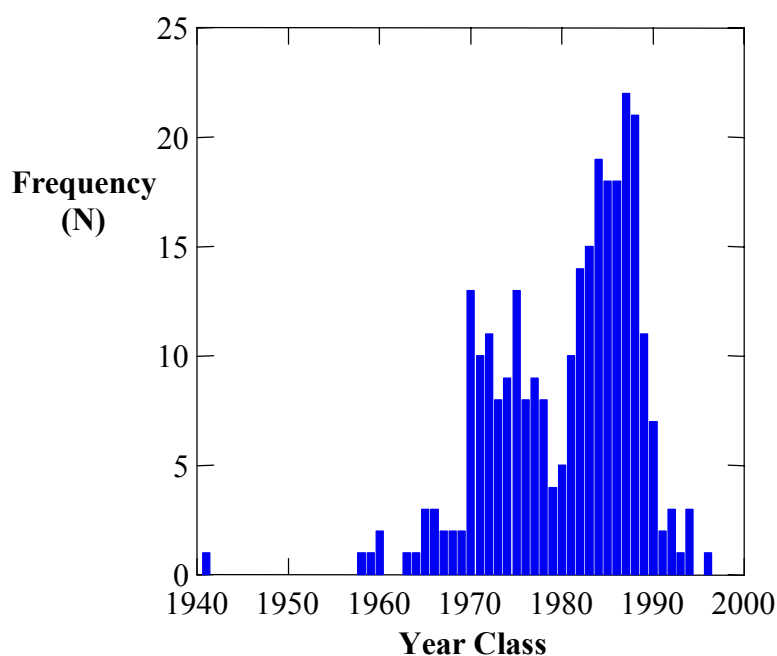
Table 1. Lake Sturgeon Catch Data; Mississauga Chutes: 1999-2002.

Project Dates	Water Temperatures (degrees Celcius)	Number of Lake Sturgeon Captured			
		Males	Females	Unknown	Total
May 11-28, 1999	14-16	12	5	44	61
May 3-25, 2000	11-15	22	6	32	60
May 4- Jun. 9, 2001	10-18	14	4	79	97
Apr. 29 – Jun. 19, 2002	5-15 ^{1.}	32	41	72	145
Total		80	56	227	363

1. Water temperatures not recorded past June 11th.

The sex ratio over the four projects was 1.4 males to 1.0 female. The sex could not be determined for 62.5 percent (N=227) of captured fish which were green or had already spawned at the time they were captured. Tags were applied to 269 lake sturgeon and ages were determined for 282 individuals.

Lake sturgeon ranged from 6 years to 60 years of age. The sample consisted of individuals from a total of 37 year classes making up a bi-modal age-frequency distribution (Figure 5). The two modes appear to be 1981 to 1989 year classes and 1970 to 1978 year classes making up 51 percent and 21 percent of the total sample, respectively. The two modes are defined by two poor year classes, 1978 and 1979. These two modes were evident during each year that lake sturgeon were assessed (Figure 6). Table two summarizes mean age, length and weight data. The youngest male and female identified were estimated to be 8 years and 10 years old, respectively. Both these individuals were spent at time of capture. A total annual mortality rate of 12.3 percent was calculated using year class frequency data pooled from all four years.

**Figure 5. Year Class - Frequency (N) Distribution of Lake Sturgeon; Mississauga River: 1999-2002.**

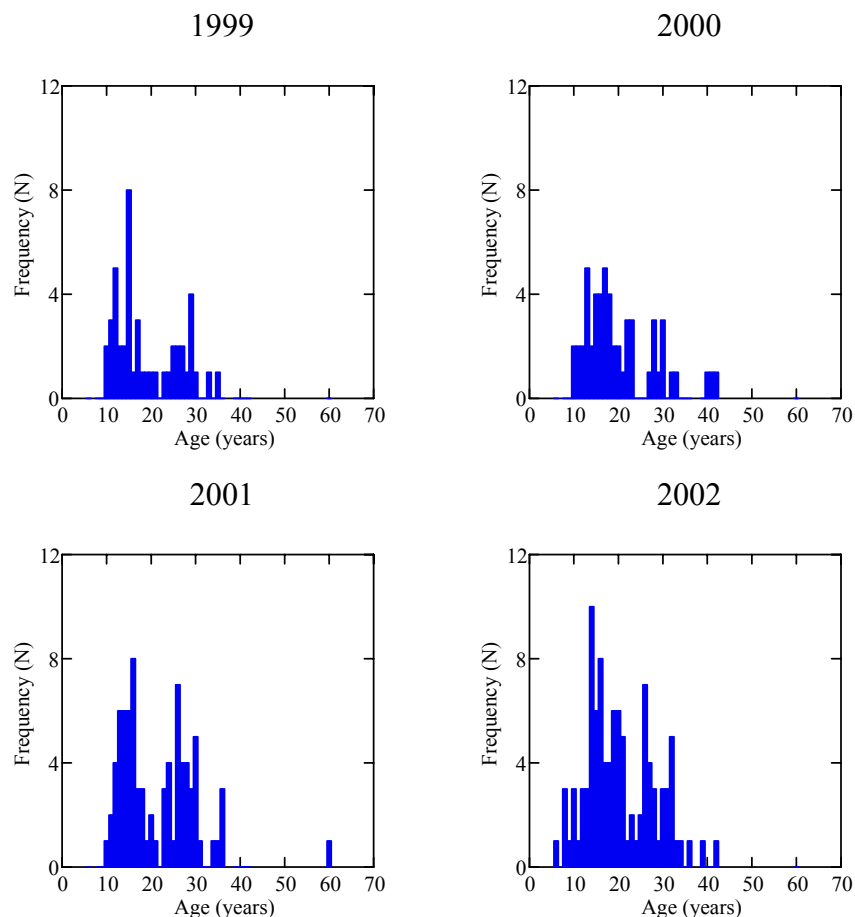


Figure 6. Age (years) - Frequency (N) Distribution of Lake Sturgeon; Mississauga River: 1999-2002.

The mean ages of male and female lake sturgeon were estimated to be 16.2 years and 25.6 years, respectively. Table two summarizes mean age, length and weight data for males, females and sexes combined. Figure seven illustrates the total length-frequency distribution for all captured lake sturgeon.

Table 2. Mean Age (years), Lengths (cm) and Weight (kg) of Captured Lake Sturgeon; Mississauga Chutes: 1999-2002.

Biological Characteristic	Males	Females	Sexes Combined (including sex = unknown)
N	75	49	282
Mean Age (years)	16.2	25.6	20.5
Mean Fork Length (cm)	113.7	134.6	122.3
Mean Total Length (cm)	124.2	147.0	133.0
Mean Round Weight (kg)	11.9	19.8	16.1

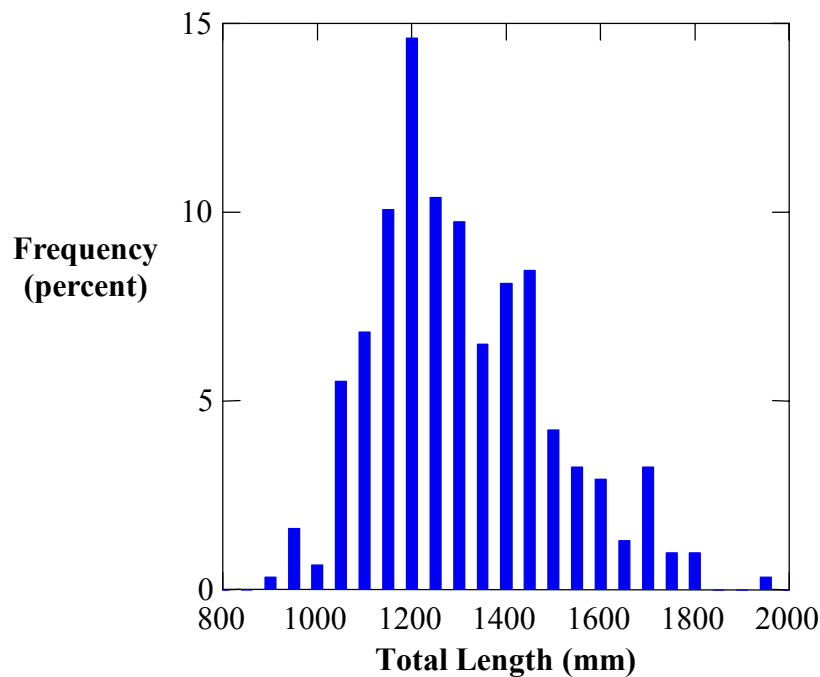


Figure 7. Total Length (mm) – Frequency Distribution of Lake Sturgeon; Mississauga River (1999-2001).

The total length-at-age equation (von Bertalanffy) best describing lake sturgeon growth (sexes combined) is:

$$\text{Total Length} = 158.9 \cdot e^{-0.0999(\text{age})} \quad r^2 = 0.642$$

The total length-at-age equation (natural log) best describing growth (sexes combined) is:

$$\text{Total Length} = 383.5 \ln(\text{age}) + 208.5 \quad r^2 = 0.998$$

Total length-at-age data for all captured lake sturgeon is summarized in appendix one.

Discussion

The projects completed from 1999 to 2002 have provided evidence that lake sturgeon congregate to spawn at the base of the lower falls on the Mississauga River. The completed projects were not designed to determine if, or what proportion of these lake sturgeon are seasonal inhabitants of the River. Mississauga First nation residents report that lake sturgeon are present near the Chutes throughout the summer. The absence of significant numbers of small, juveniles in net catches suggests that they utilize habitat elsewhere in the North Channel, at least during the spring.

This database represents a reference point from which to conduct further, more intensive assessments. A population size estimate could not be calculated due to length of this project (4 years) which was too short to expect a large number of repeat spawning events. No tag returns were reported despite the fact that fishers from the Mississauga First Nation harvest lake sturgeon at this site.

The projects conducted on the Mississauga River show that this lake sturgeon population consists of at least 37 year classes. This is fairly consistent with the results of biological sampling conducted elsewhere on Lake Huron. Sampling completed by the Ontario Ministry of Natural Resources on northern and southern Lake Huron detected 33 and 40 year classes, respectively (OMNR unpub. data 2002). A comparison of total length-at-age shows that lake sturgeon from the Mississauga River grow at a faster rate than lake sturgeon sampled elsewhere in Lake Huron (Figure 8).

Individuals from every year class from 1963 until 1994 were represented in our sample, suggesting that lake sturgeon successfully reproduce in the Mississauga River every year. The first recognizable pulse of strong year classes was 1970 to 1978, occurring approximately a decade after the construction of the Red Rock dam, followed by a second, stronger pulse made up of the 1981 to 1990 year classes. Total annual mortality appears to be relatively low at 12.3 percent.

Lake sturgeon from recent year classes (e.g. produced after 1994) were probably sexually immature and were not present at the Mississauga Chutes spawning site during sampling and/or were too small to recruit to our netting gear.

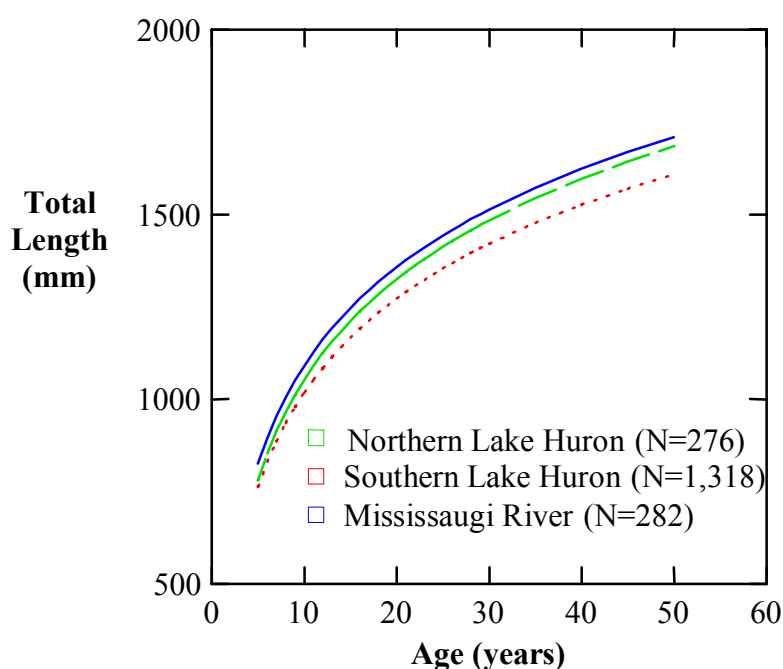


Figure 8 Total Length (mm)-at-Age (years) for Lake Sturgeon Sampled in Northern Lake Huron (OMNR unpub. data 2002), Southern Lake Huron (OMNR unpub. data 2002) and the Mississauga River (1999-2000).

Many gaps remain in our understanding of the behavior and dynamics of lake sturgeon utilizing the Mississauga River. These include:

- Timing of adult lake sturgeon movements entering the River in order to access spawning habitat and determination if some adults may be permanent residents of the river
- Lake sturgeon abundance and habitat utilization between the Red Rock hydroelectric dam and the Chutes (our sampling site)
- Identification of egg deposition areas and determination of whether or not daily peaking operations below the red Rock dam affect spawning/hatching success and larval survival
- An estimate of lake sturgeon abundance
- Identification of juvenile lake sturgeon habitat within the River and/or in the North Channel
- An estimate of current harvest by Mississauga First Nation fishers

Filling all of these information gaps would require significant time and resources. As a minimum, we recommend that similar spring assessment projects be undertaken for five to seven consecutive years during every twenty year period in order to identify changes in lake sturgeon age structure and mortality and that lake sturgeon movement continues to be monitored through the collection of tag return data.

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Appendix 1. Fork Length and Total Length-at-Age Summary for Mississauga River Lake Sturgeon: 1999-2002.

Age (years)	Number (N)	Total Length (cm)	Fork Length (cm)	Age (years)	Number (N)	Total Length (cm)	Fork Length (cm)
6	1	96.0	85.5	30	12	151.4	142.2
7	--	--	--	31	4	144.4	133.7
8	3	104.6	94.0	32	6	158.3	146.2
9	1	115.0	105.0	33	3	147.8	137.0
10	8	112.5	103.6	34	2	169.5	154.2
11	8	110.8	101.8	35	2	156.0	147.5
12	14	112.6	102.3	36	4	164.6	147.6
13	16	118.0	107.6	37	--	--	--
14	20	121.5	111.3	38	--	--	--
15	24	122.4	111.8	39	1	162.0	152.0
16	21	121.8	111.5	40	1	171.0	150.0
17	15	125.7	115.4	41	1	177.0	163.0
18	12	123.1	112.9	42	2	148.0	131.0
19	10	126.0	117.0	43	--	--	--
20	11	134.6	123.7				
21	8	136.4	123.9	60	1	182.0	170.5
22	4	128.7	119.7				
23	9	143.2	131.5				
24	6	136.2	127.6				
25	5	151.0	138.1				
26	16	154.7	142.5				
27	11	142.9	138.0				
28	11	148.8	138.0				
29	9	148.4	137.2				